

Splinter Meeting of the IGS Antenna Working Group

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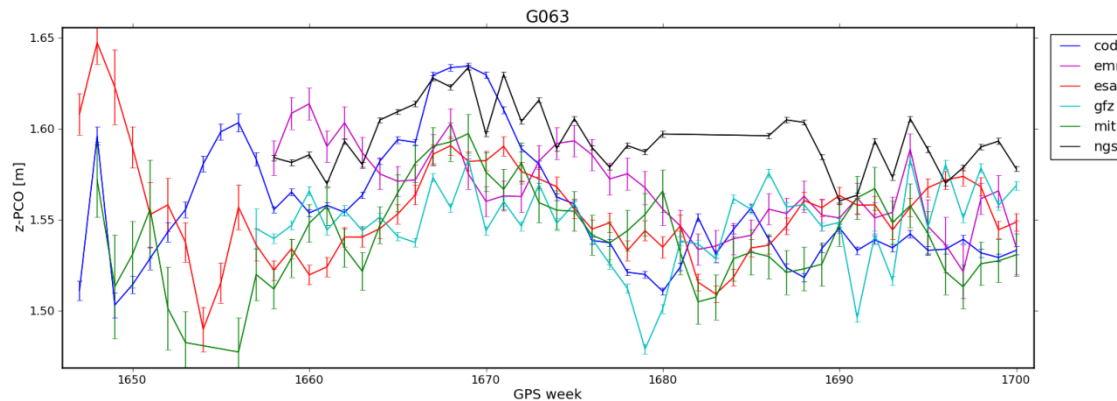
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1. Satellite antenna issues

1.1 repro2/ITRF2013 implications

- reestimate z-offsets of **latest** satellites: G064, G065, G066, (G067), R743, R747, (R754)
- keep terrestrial IGS08 scale or reestimate **all** z-offsets in case ITRF2013 scale differs significantly from ITRF2008 scale?
- update of **receiver** antenna calibrations when switching to ITRF2013/IGS13? (e.g.: ASH701073.1 calibrations provided by the University of Hannover)



1. Satellite antenna issues

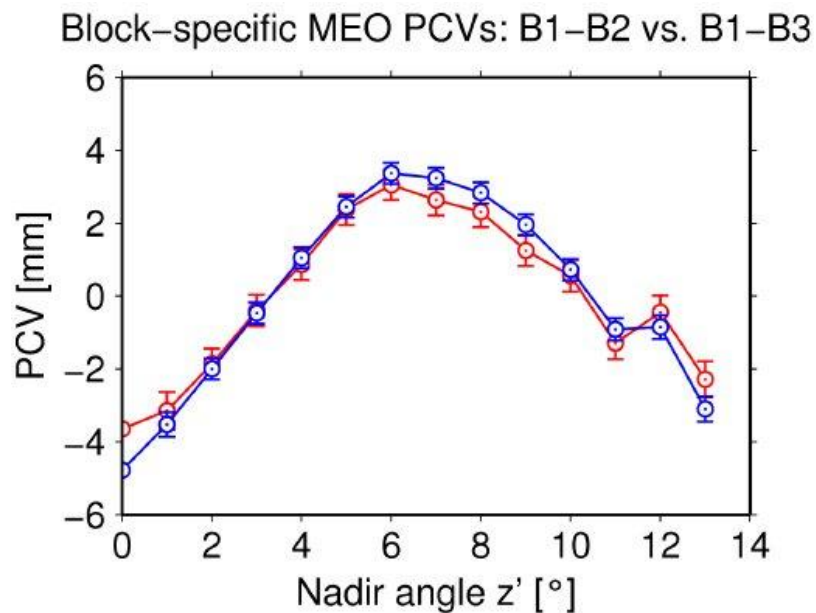
1.2 Combined processing of terrestrial and LEO data

- goals: IGS to provide **independent** terrestrial **scale**; consideration of azimuth-dependent PCVs
- requirements: reanalyzing the full history of IGS/LEO data to derive new satellite antenna PCVs by **at least two ACs** considering:
 - igs08.atx/igs13.atx receiver antenna calibrations
 - multiple GNSS (at least GPS and GLONASS)
 - nadir angles up to 17 deg
 - azimuth-dependence
- date: new set of satellite antenna corrections should be available before the start of **repro3**

1. Satellite antenna issues

1.3 Estimation of phase center corrections for new GNSS

- conventional phase center offset values available on the MGEX website
- cf. poster presentation by Dilssner et al.: *Estimation of satellite antenna phase center corrections for BeiDou*
- other initiatives?



Dilssner (2014)

2. Receiver antenna issues

2.1 Status of new calibration institutions

National Geodetic Survey (NGS):

- L2 tracking issue solved?
- status of the GLONASS calibration?

Geoscience Australia (GA):

- comparisons needed in order to be accepted as an IGS calibration institution
- any experience with robot calibrations for the BeiDou frequencies?



2. Receiver antenna issues

2.2 Chamber calibrations from Bonn for MGEX purposes

- University of Bonn provided chamber calibration sets for 15 different antenna/radome combinations including 18 frequencies
- W. Aerts and M. Moore provided comparison with igs08.atx for GPS and GLONASS frequencies of 13 antenna types: good agreement for 5, “fair” agreement for 6 and poor agreement for 2 antenna types
- in accordance with ANTEX 1.4, all 18 frequencies can only be added separately, even though some of them are identical (update of the ANTEX format needed)
- as existing igs08.atx calibrations cannot be changed, only short-term possibility is to merge chamber (new frequencies) with robot calibrations (GPS/GLONASS)
- possible inconsistency could be removed with igs13.atx?

2. Receiver antenna issues

2.3 Strategies to compare phase center calibrations

- two common strategies to define the “datum” of phase center corrections (PCC) resulting in different comparison residuals:
 - $\text{PCC}(\text{zenith direction}) == 0$
 - $\text{mean}(\text{PCC}) == 0$
- unclear to which strategy the thresholds for “acceptable” PCC differences agreed upon in Newcastle refer
- datum-independent quality measures focusing on the shape of the PCC could be helpful
- status of the toolbox?

2. Receiver antenna issues

2.4 Campaign to compare calibrations with “ground truth”?

- several institutions generally interested to do comparisons: Royal Observatory of Belgium, Finnish Geodetic Institute, University of Luxembourg, others?
- organized comparison campaign desired?
- any antenna samples available that were already calibrated by multiple calibration institutions?
- besides coordinates also troposphere and clock parameters should be analyzed

3. ANTEX format

3.1 MGEX-related issues

Identical frequencies for different GNSS

- e.g.: G01 = E01 = J01 = S01
- currently, calibration values have to be duplicated
- solution: allow further entries in *START OF FREQUENCY* section

G01 E01 J01 S01

START OF FREQUENCY

3. ANTEX format

3.1 MGEX-related issues

Manufacturer-defined spacecraft body frames and attitude modes

- necessary to consider conventional phase center offsets etc.

Constellation		Attitude Mode	Compatibility with IGS Attitude Model
GLONASS-M/K		yaw-steering	Requires mapping ($+x_{GLO} = -z_{IGS}$, $+y_{GLO} = +x_{IGS}$, $+z_{GLO} = -y_{IGS}$)
GIOVE-A/B		yaw-steering	Requires mapping ($+x_{GIO} = -x_{IGS}$)
Galileo IOV		yaw-steering	Requires mapping ($+x_{GAL} = -x_{IGS}$)
QZSS		yaw-steering	Requires mapping ($+x_{QZSS} = -x_{IGS}$)
		orbit-normal	NO
BeiDou	MEO	yaw-steering	Yes*)
BeiDou	IGSO	?	?
BeiDou	GEO	orbit-normal (?)	NO
SBAS		orbit-normal (?)	NO

Montenbruck (2012)

3. ANTEX format

3.2 RMS section

- ANTEX format description **not practicable**

* START OF FREQ RMS	Record indicating the start of an rms value section related to the specified frequency. The section includes the rms values of the phase center eccentricities and of the phase pattern values.	3X, A1, I2, 54X *
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- as PCO and PCVs are intimately connected, separate RMS values make no sense
- **only PCV RMS** should be provided
- should it be allowed to provide RMS values for a subset of frequencies only? (Geo++ can currently provide GPS RMS, but no GLONASS RMS)
- reasonable to include RMS sections into the official IGS model?

3. ANTEX format

3.3 Various issues (what is necessary and practicable?)

- consideration of individual GLONASS frequencies
- code calibrations for satellite and receiver antennas
- (receiver-dependent) carrier-to-noise patterns C/N_0
- near- and/or far-field effects?
- station-specific empirical biases?

4. CB antenna file issues

4.1 rcvr_ant.tab

- accepted as a standard by manufacturers; maintenance gets more and more time-consuming
- could data flow between calibration institutions and the CB be optimized?

4.2 antenna.gra

- definition of the **north reference point (NRP)** ready to be published
- compromise for JAVGRANT antennas necessary
- “call for photos” to replace NRP=UNK after publication
- antennas at IGS stations should **not** be touched in case the orientation was not in accordance with antenna.gra! (comment in the station log might be helpful)

5. Any other business

**Further questions
or comments?**